

USAWC STRATEGY RESEARCH PROJECT

AGRICULTURAL BIOTERRORISM: WHAT CHALLENGES AND ACTIONS REMAIN?

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This SRP is submitted in partial fulfillment of the requirements of the Master of Strategic Studies Degree. The U.S. Army War College is accredited by the Commission on Higher Education of the Middle States Association of Colleges and Schools, 3624 Market Street, Philadelphia, PA 19104, (215) 662-5606. The Commission on Higher Education is an institutional accrediting commission recognized by the U.S. Secretary of Education and the Council for Higher Education Accreditation.

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USAWC CLASS OF 2006

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Report Documentation Page

*Form Approved
OMB No. 0704-0188*

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1. REPORT DATE 15 MAR 2006	2. REPORT TYPE	3. DATES COVERED 00-00-2005 to 00-00-2006		
4. TITLE AND SUBTITLE Agricultural Bioterrorism What Challenges and Actions Remain?		5a. CONTRACT NUMBER		
		5b. GRANT NUMBER		
		5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) Steven Wieneke		5d. PROJECT NUMBER		
		5e. TASK NUMBER		
		5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army War College,Carlisle Barracks,Carlisle,PA,17013-5050		8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)		
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited				
13. SUPPLEMENTARY NOTES				
14. ABSTRACT See attached.				
15. SUBJECT TERMS				
16. SECURITY CLASSIFICATION OF: a. REPORT unclassified		17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES 28	19a. NAME OF RESPONSIBLE PERSON
b. ABSTRACT unclassified				
c. THIS PAGE unclassified				

ABSTRACT

AUTHOR: Lieutenant Colonel Steven A. Wiencke

TITLE: Agricultural Bioterrorism: What Challenges and Actions Remain?

FORMAT: Strategy Research Project

DATE: 10 March 2006 WORD COUNT: 6,663 PAGES: 27

KEY TERMS: Agriculture, Agroterrorism, Bioterrorism, Infrastructure, Vulnerabilities

CLASSIFICATION: Unclassified

The threat of agricultural terrorism in the United States has awakened the nation to the stark reality that its agricultural industry may be in jeopardy. Intentional attacks delivered by land, air and sea are capable of devastating this nation's agricultural infrastructure, its economy and ultimately threaten the survival of the citizens and the quality of life we have taken for granted. Preparations taken to identify vulnerabilities, implementation of prevention measures, and actions taken in response to an attack will determine the magnitude of the impact of an agricultural incident.

This paper will present the bioterrorism threat the United States agricultural infrastructure faces. It will review the nature and threat of agricultural terrorism against livestock and croplands and demonstrate the degree of vulnerability the United States agricultural industry has against a bioterrorism attack. This paper will identify current plans, policies, initiatives and capabilities available at the local, state and federal levels. It will review actions that should be implemented in order to strengthen this nation's ability to prevent, prepare for, respond to and mitigate long-term consequences that could devastate the nation's economy.

AGRICULTURAL BIOTERRORISM: WHAT CHALLENGES AND ACTIONS REMAIN?

Since the attacks of September 11, 2001, Americans have become acutely aware of their vulnerability to terrorism. This has heightened their need to be aware of their surroundings and to be prepared for the possibility of future clandestine attacks within their borders. These potential attacks are not aimed to achieve a strategic military victory, but to cause indiscriminate destruction, economic disruption, widespread injury, fear, uncertainty, and erosion of consumer confidence.

This paper will identify U.S. vulnerabilities to bioterrorism threats against non-human systems. Five areas will be reviewed to evaluate the potential of a terrorism attack targeted against the U.S. agricultural infrastructure. First, the author will address types of threats to the nation's agricultural sector. Secondly, the author will examine national interests and the economic importance of the nation's agricultural industry. Thirdly, the author will examine critical vulnerabilities and challenges associated with protecting vital agricultural infrastructure. Fourth, the author will examine how U.S. Homeland Security Presidential Directive 9 (HSPD-9)¹ protects the nation's agricultural infrastructure against terrorist attacks. Finally, the author will identify problems and recommend prioritized protective measures to harden the agricultural infrastructure from damages.

Defining Agricultural Bioterrorism

Understanding agricultural bioterrorism begins with knowing what constitutes terrorism and the nature of the agricultural industrial complex or agribusiness. Webster's Dictionary defines *agriculture* as, "the science, art, or practice of cultivating the soil, producing crops, raising livestock, and in varying degrees the preparation and marketing of the resulting products."² Webster further defines *agribusiness* as "an industry engaged in the producing operations of a farm, the manufacture and distribution of farm equipment and supplies, and the processing, storage, and distribution of farm commodities."³

Dr. Peter Chalk, Policy Analyst, RAND Washington Office, defines *agricultural bioterrorism* as:

the deliberate introduction of a biological agent or bio-toxin, either against livestock or into the food chain, for purposes of undermining stability and/or generating fear. Depending on the disease agent or vector chosen, it is a tactic that can be used either to generate mass socio-economic disruption or as a form of direct human aggression.⁴

When combining the dictionary definition of agriculture with Chalk's definition, *agricultural bioterrorism* may be defined as: an act in which terrorists attack livestock, crops, food preparation or distribution centers or food storage locations (food for either human or animal consumption) using biological agents or toxins in order to further their political, economic, or social objectives.

Agroterrorism is a subset of bioterrorism, and is defined as the deliberate introduction of an animal or plant disease with the goal of generating fear, causing economic losses, and/or undermining stability.⁵ Presidential Executive Order 13112 defines invasive species as a species that is non-native or alien to the ecosystem under consideration, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. An invasive species can be a microbe, plant, animal, or other organism.⁶

Types of Threats

Types of threats include bacterial, viral, fungal, contamination of livestock feeds, contamination of human food sources, biological and chemical sources, introduction of foreign plant and animal diseases and genetically modified cultures. Dr. Kathleen Bailey, National Institute for Public Policy and author of the textbook, *Doomsday Weapons in the Hands of Many*, describes the nature of biological agents and toxins subject to weaponization as the following.

Biological agents are disease causing organisms and materials, whether they are viral, bacteriological, rickettsiae, fungal, or protein. They may cause damage to or death of humans, other animals, or plants. Toxins are harmful chemicals that can be produced by bacterial, marine organisms, fungi, plants, and animals. Biological and toxin weapons (BTW) are devices that can be delivered by aerosol sprayers or munitions, designed to deliver biological agents to a target population.⁷

Bacteria are single-cell organisms. An example of a bacterial agent is *Bacillus anthracis*, a hardy bacterium that causes the highly lethal disease pulmonary anthrax. *Rickettsiae* are bacteria that can only reproduce inside of animal cells. A well-known example is *Coxiella burnetii*, which causes Q fever.⁸

Viruses are intracellular parasites consisting of a strand of genetic material (DNA or RNA) surrounded by a protective coat that facilitates transmission from one cell to another. An example of a virus that could be used as a weapon is the *Variola* virus, the virus that causes smallpox.⁹

Fungus are any of a major group (Fungi) of Saprophytic and parasitic lower plants that lack chlorophyll and include molds, rusts, mildews, smuts, mushrooms, and yeasts. Fungal agents ordinarily do not cause disease in healthy humans or animals, although they can be devastating to those with

deficient immune systems. Rather fungi that have been developed as weapons have predominantly been those that cause diseases of plants.¹⁰

Some Proteins can be used as weapons. Most bacterial toxins are large proteins that either affect the nervous system (neurotoxins) or damage membranes. An example of a neurotoxin is the toxin secreted by Clostridium botulinum, the most poisonous substance known. A fatal dose of botulinum toxin A by injection or inhalation is about one nanogram (one billionth of a gram) per kilogram. Staphylococcal enterotoxins (an incapacitant) and botulinum toxins are 1,000 to 10,000 fold more toxic than classical nerve agents.¹¹

Low-molecular-weight toxins may either organic molecules or peptides. Examples of low-molecular-weight toxins are saxitoxin, a neurotoxin found in some shellfish, and trichothecene mytoxins, which are produced by fungi. Some low-molecular-weight toxins can be produced by chemical synthesis.¹²

Background

A global web of terrorist groups to include Al Qaeda has purportedly indicated interest in exploiting weaknesses in the U.S. food and agriculture industry, although little information on that threat is publicly available.¹³ After the September 11, 2001 attacks, the U.S. learned that Al Qaeda had accumulated vast amounts of information about the U.S. agricultural sector. Their training manuals contained specific information regarding how they planned to disrupt and destroy concentrated livestock and crop production facilities and food supply processes in the agricultural industry.¹⁴

According to Dr. Floyd P. Horn, former Director of Food, Agriculture, and Water Security in the White House Office of Homeland Security, Al Qaeda and other terrorist groups are committed to developing and deploying weapons of mass destruction against U.S. targets. Horn states it is a matter of 'when' not 'if' such weapons will be used for lethal purposes.¹⁵

The possible use of biological or chemical weapons or the introduction of invasive species against any sector of the U.S. agricultural industry represents a major threat to the homeland.¹⁶ The U.S. Department of Agriculture (USDA) indicates the agriculture sector contributes \$1.5 trillion to the nation's gross domestic product.¹⁷ This sector receives far less attention and funding than possible attacks on human systems that result in immediate loss of the population.¹⁸

Prior to 9/11, little attention was given to agricultural terrorism or to the roles and responsibilities of the public and private sectors to deter and respond to potential attacks. Few Americans appreciated the gravity of the threat of terrorist attacks against our agriculture and food system infrastructure. This issue was ignored in a General Accounting Office (GAO) report on combating terrorism released nine days after the attacks of September 2001.¹⁹

This report failed to address threats to American agriculture and the USDA did not participate in the development of the GAO report. The report focused only on terrorism directed against human civilian targets. The GAO explained that agriculture was not included in the report on combating terrorism because it had not been designated a critical national infrastructure and there had not been any major catastrophe affecting the agriculture infrastructure.²⁰

Protecting the agriculture and food industry as a critical infrastructure was addressed in December 2003 by Homeland Security Presidential Directive 7 (HSPD-7), “*Critical Infrastructure Identification, Prioritization, and Protection*.²¹ More specific recognition came on January 30, 2004, when The White House released Homeland Security Presidential Directive 9 (HSPD-9), “*Defense of the United States Agriculture and Food*”. This directive established a national policy that defines how various agencies will work together to protect the agriculture and food system against terrorist attacks, major disasters, and other emergencies.²²

Historical Evidence

Historical evidence demonstrates that a number of nations and groups have deliberately introduced biological and chemical agents and invasive species targeted against plants, animals and humans as tools of warfare for over 2,000 years. While not meant to be an exhaustive list, this section will highlight some incidents of biological agents and invasive species being used against plants, animals and humans and will illustrate the impact these events have had on a country's food supply and economy.

During 6th Century B.C., Assyrians poisoned enemy wells with rye ergot.²³ In 1346, Tartars catapulted bodies of victims infected with bubonic plague over the walls of Kaffa.²⁴ During the French-Indian War, British soldiers gave blankets used by smallpox victims to Native Americans.²⁵

In 1915, a German-American physician inoculated 3,000 head of horses, mules, and cattle destined for Allied Forces in Europe with anthrax and glanders bacteria.²⁶ In 1918, the Japanese formed a biological weapons section (Unit 731).²⁷ In 1942, the U.S. began research into the offensive use of biological weapons.²⁸ In 1952, the Mau Mau (members of the Kikuyu tribe) killed 33 head of cattle at a Kenyan mission station using a local toxic plant known as African milk bush.²⁹

In 1966, *Bacillus subtilis* was released in the New York City subway system to test the vulnerability of biowarfare.³⁰ In 1984, the Baghwan Shree Rajneesh cult contaminated salad bars of ten restaurants in Dallas, Oregon, with *Salmonella Typhimurium*, demonstrating the

ease of conducting a small scale, indiscriminate terrorist attack that poisoned over 750 people.³¹ In 1995, a Japanese doomsday cult released sarin gas in Tokyo subway stations.³²

In 1999, the glassy-winged sharpshooter, an invasive insect that hosts the bacterium *Xylella Fastidiosa* was detected in California and is believed to have arrived on imported plants. This insect transmits and spreads Pierce's Disease in grapes which kills infected grapevines. Several outbreaks of the disease required destruction of the diseased plants and a major replanting of grapevines, resulting in a reduction of grape production. Tourism and grape-related industries are collectively worth \$35 billion in California. This insect produced a \$40 million loss in California's grape, wine, and raisin industry and an undisclosed amount in the tourism industry.³³

In 2001, a foot-and-mouth disease (FMD) outbreak in the United Kingdom forced the government to slaughter 11 million infected animals at a cost of nearly \$30 billion to the British economy.³⁴ Indirect costs associated with replacing animal breeding stock, destruction of animals, environmental clean up, erosion of public confidence of this food source, reduced revenues of exports, and decreased tourism all contributed to this devastating economic impact.

National Interests

Two national interests directly related to this issue are at stake. First, the security of the homeland to protect against an attack on the territory and people of a nation-state in order to ensure survival with fundamental values and political systems remain intact. Second is the economic well-being or attainment of the conditions in the world environment that ensure the economic well-being of the nation.³⁵ Protecting the nation's agricultural infrastructure and food supply against terrorist attacks is a vital interest. The health and survival of our citizens, the nation's economic well-being, and maintaining the existing standard of living are vital interests we must protect.

The USA Patriot Act defines critical infrastructure as those systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of these matters. The current Bush administration recognizes agriculture and food as critical infrastructure that provide the essential goods and services Americans need to survive.³⁶

Safeguarding our agricultural infrastructure for the survivability and health of our citizens, and for the sustainment or expansion of agricultural export markets providing increased profitability, will maintain or strengthen the existing economic well-being and standard of living.

If the U.S. government does not fund and implement acceptable protective measures to protect the nation's agricultural infrastructure, the nation risks erosion of long-term consumer confidence. The nation also risks providing high quality food products, losing marketing agricultural commodities caused by trade restrictions, and significantly increasing the probability that food product prices will increase.

Economic Importance

To understand the threat against the agricultural industry, citizens must understand the importance in terms of value to the nation's economy. The U.S. agricultural system is the most productive and efficient in the world, enabling Americans to spend 12.7 percent of their disposable income on food, compared to a global average of 20-30 percent.³⁷ The collective food and fiber industry, to include farm agricultural production, processing, manufacturing, exports and related services, is the largest segment of the U.S. economy. It accounts for over 16 percent of the gross domestic product and 17 percent of the civilian labor force.³⁸ The value of U.S. agricultural exports in 2003 exceeded \$59 billion.³⁹

According to Robert Armstrong, a senior research fellow in the Center for Technology and National Security Policy at the National Defense University, agriculture will become an increasingly important part of the nation's industrial base, as it offers the most economical way to produce large quantities of biological materials (plants and animals) to sustain a domestic biobased economy of the future.⁴⁰ In its vision statement for the 21st century, the National Agricultural Biotechnology Council forecasts agriculture to be the source of not only our food, feed, and fiber, but also our energy, materials and chemicals.⁴¹ This is possible because the U.S. has among the largest amount of arable land per capita of any country in the world.⁴² Technological innovations in agricultural production are also expected to increase production significantly.

In 2002, total U.S. agricultural sales were valued at over \$202 billion.⁴³ California was the leading agricultural state with sales valued at \$23 billion; Texas was second with \$13.7 billion; followed by Iowa at \$11.9 billion; Nebraska at \$9.8 billion, and Kansas at \$9.2 billion. These top five states accounted for 34 percent of the U.S. total.⁴⁴

Crop production in the U.S. is most vulnerable where it is concentrated in the following areas: 92.2 percent of grapes, 47 percent of tomatoes, 77.8 percent of lettuce, 100 percent of almonds and 75.5 percent of strawberries are grown in California; 76.5 percent of citrus in Florida; 83.3 percent of red raspberries, 77.3 percent of hops and 55 percent of apples in Washington.⁴⁵

The Midwest annually produces more than 80 million cattle, hogs, sheep, goats and bison and is more economically exposed to the threat of agroterrorism than any other region in the country. The simultaneous contamination of several livestock production and processing facilities could cripple the nation's food supply, force the destruction of a large portion of the country's livestock (through mass culling), and result in the layoffs of thousands of feedlot workers and processors.⁴⁶

The concentration of livestock raised in indoor confinement operations or large scale outdoor feedlots increase the potential impact of an agroterrorist attack. Concentration examples in the U.S. include: hog production in Iowa 26 percent, North Carolina 16 percent and Minnesota 11 percent make up a total of 53 percent; beef cattle production in Texas 15.4 percent, Nebraska 13.1 percent and Kansas 12.7 percent make up a total of 41 percent.⁴⁷

A positive disease reading would likely trigger an international embargo of U.S. livestock and crop products, about 24 percent of which are exported annually. In the Midwest, some \$20 billion in agricultural commodity exports are at risk. The on-going consolidation of U.S. agricultural facilities and assets is of particular concern. Larger facilities not only render an attack easier to execute, they also exacerbate the impact of a terrorist event if animals in close proximity to each other can easily spread a biological or chemical agent.⁴⁸

Effects of Problems

Dr. Peter Chalk, Policy Analyst, RAND Washington Office, identifies three major potential effects of an agroterrorist attack. The first effect of terrorist attacks would create mass economic destabilization, generating costs that could be expected to cross three levels. First, there would be direct economic losses resulting from containment measures and the destruction of disease ridden livestock. Second, indirect multiplier effects would accrue both from compensation costs paid to farmer for the destruction of agricultural commodities and losses suffered by both directly and indirectly related industries. Finally, international costs in the form of protective trade embargoes imposed by major external trade partners would manifest.⁴⁹

The second effect that poses the greatest threat to the agricultural industry are disease and contamination of the food supply. Even without the threat of terrorism, food-borne diseases cause 76 million illnesses each year, 325,000 hospitalizations, and over 5,000 deaths, creating an economic cost that by some estimates ranges up to \$32 billion.⁵⁰

The third effect being a successful agroterrorism act would undermine political support and confidence in the government.⁵¹ Terrorists could use acts of terrorism to their advantage,

creating social instability and a general atmosphere of fear and anxiety without actually having to carry out indiscriminate civilian-oriented attacks.⁵²

To date, efforts to combat agricultural bioterrorism have focused primarily on prevention. Significantly fewer resources are dedicated to preparing for the aftermath of such an event. Although a strong prevention program is necessary, an over-dependence on prevention with little attention on preparedness and consequence management could create a false sense of security. A balance between prevention and preparedness is needed.⁵³ We need to plan, invest and implement acceptable protective measures to guard against future terrorist attacks on the United States agricultural infrastructure, which could have catastrophic health and economic effects.⁵⁴

The United States faces complex challenges that limit the nation's ability to quickly and effectively respond to attacks against our food supply. Since HSPD-9 was published, significant progress has been achieved, but serious protection gaps remain that leaves the safety of the nation's agricultural infrastructure and food supply extremely vulnerable to future terrorist attacks. All sectors of the nation's agricultural industry must remain vigilant in the preservation of the present infrastructure, and be creative in identifying and implementing new protective measures to prevent and mitigate damages that may occur in the future.

Critical Vulnerabilities and Challenges

The United States agricultural industry is highly vulnerable to disease, pest, or poisonous agents that occur naturally, are unintentionally introduced, or are intentionally delivered by acts of terrorism. America's agricultural infrastructure is an extensive, interconnected, highly accessible, diverse, and complex structure providing potential targets for terrorist attacks.

Potential targets include herds of livestock; crops in the fields; grain storage facilities; transport vehicles such as over-the-road tractor-trailer trucks, railcars, river barges and ships; river locks and dams; seaport terminals; agricultural product processing facilities; food handlers; warehouse storage; research laboratories; water supplies; food items in the processing and distribution chain; wholesale and retail food outlets; market ready foods (wholesales/trade); distribution point of sales; livestock feeds; restaurants; producers and farm workers.⁵⁵

Crop and livestock losses from contamination by mycotoxins (toxins produced by fungi) alone cost the U.S. on average \$932 million annually.⁵⁶ Humans can also be exposed to a range of deadly or debilitating toxins by ingesting contaminated plant and animal products, or less frequently by contact or inhalation.⁵⁷ Improper storage, poor sanitation, and cross-

contamination during the production, transportation, processing, or storage of medicine, food supplies, or other consumables can further spread toxins or biological agents.

Agricultural experts believe the greatest terrorist threat to the U.S. agriculture industry would be the deliberate introduction of FMD, the highly contagious viral disease that attacks cloven-footed animals, such as cattle, swine, sheep, deer and elk.⁵⁸ The U.S. agricultural infrastructure and food supply system is highly vulnerable because security and surveillance at most agricultural facilities is low or non-existent. Almost all severe, highly contagious diseases of livestock have been eradicated from the U.S. and any vaccine is either nonexistent or rarely employed as a matter of policy, thus making livestock in America increasingly susceptible to foreign animal diseases.

Recognizing a potential livestock epidemic early in its course is a difficult task. Determining whether such an event is an accident or deliberate act is even more challenging. It is also important to determine whether the causal agent is a high-risk, non-indigenous pathogen or a new or more virulent strain of an existing pathogen. Major outbreaks could occur in the U.S. from non-indigenous pathogens that are minor problems elsewhere in the world or could be initiated by unknown or unidentified pathogens.⁵⁹

Signs of infection may manifest slowly and result in delayed awareness and treatment. Once a disease is introduced into the animal or crop population, it can spread widely before being detected. Farmers are not trained to recognize foreign animal diseases. An inefficient passive disease reporting system is hampered by a lack of trust between regulators and producers and can cause delays in reporting problems and increase the chance of spreading disease. Too few trained veterinarians are capable of recognizing and treating exotic livestock diseases in the U.S. because fewer veterinarians focus on large scale livestock husbandry compared to domestic pets.

Today, American farmers produce livestock and crops that have become more geographically consolidated which means the use of anti-animal or anti-crop agents could be focused in relatively few locations in the U.S. and impact specific agricultural commodities and food supplies resulting in domestic and international economic repercussions. Rapidly transporting livestock, feed, agriculture products, and food for human consumption over long distances makes tracing sources of contamination more difficult.

The number of knowledgeable people who work in related fields of the agricultural industry continue to decrease over time as less people are being attracted to and trained in these career fields. The use of bioterrorism agents affords anonymity to the aggressor. Public reaction to livestock being targeted may be less intense because humans are not being directly

targeted, unless the goal is food contamination. There is no national policy prescribing criminal penalties for biological poisoning of livestock herds or crop sources.

Government Response

Following the terrorist attacks of 2001, Congress and the President modified the roles and responsibilities of federal agencies to better protect against agroterrorism. The *Homeland Security Act of 2002*, created the Department of Homeland Security (DHS) as the chief coordinating agency for protecting the United States from terrorist acts, including agroterrorism. This act transferred functional roles and responsibilities and personnel from 22 different federal agencies to DHS. Congress also passed legislation that expanded the responsibilities of USDA in relation to agriculture security.

The President issued HSPD-9 which outlines agency goals and tasks for protecting against agroterrorism. This directive contains five primary objectives to protect the agriculture industry and food systems from terrorist attacks, major disasters and other emergencies. The objectives include: identify and prioritize sector critical infrastructure and key resources for establishing protective requirements; develop awareness and early warning capabilities to recognize threats; mitigate vulnerabilities at critical production and processing nodes; enhance screening procedures for domestic and imported products; and enhance response and recovery procedures.⁶⁰

Findings and Recommendations

The U.S. Government Accountability Office (GAO-05-214) Report, *Protecting Against Agroterrorism*, dated March 2005, reviewed three specific areas that focused on protecting the nation against agroterrorism. This report addressed changes since September 2001 in the roles and responsibilities of federal agencies to protect against agroterrorism, specific steps that the U.S. has taken to manage risks of agroterrorism, and what challenges and problems remain. This report in conjunction with the DHS, USDA, and Health and Human Services (HHS), as well as state, local and private sector organizations, all ask the nation policymakers to do more to protect the agriculture industry and food system.

High costs associated with expanding the protection of the nation's agricultural infrastructure impacts feasibility and acceptability considerations. Until further actions are accomplished on the U.S. GAO-05-214 report findings and recommendations and policymakers make it more important to protect the nation's agricultural infrastructure, will determine in large measure how efficient, suitable and supportable HSPD-9 becomes.

Appropriating additional funding to execute more stringent protective measures than what HSPD-9 outlines will test this nation's administration and elected officials will to expend acceptable levels of resources. The investment made to maintain a safe, bountiful and inexpensive food supply will also test the tolerance of our public taxpayers. There is great risk associated with not reacting appropriately to numerous messages from terrorists that are intent to cause Americans unpredictable harm and destruction.

Despite significant progress being made to safeguard our nation's vital agricultural infrastructure, many existing vulnerabilities and implementation requirements outlined in HSPD-9 have not been accomplished due to the lack of timely and persistent congressional funding. Most sectors of the U.S. agriculture industry continue to have inadequate infrastructure and funding to prevent, detect, respond and recover from either accidental introductions or intentional terrorist attacks.

The purpose of this section is to highlight findings and recommendations made in the U.S. GAO-05-214 report and to prioritize what I believe to be the most vulnerable targets that provide terrorists with the greatest pay-off in terms of damage that would negatively impact the nation's agricultural infrastructure and economy. Each subject matter area addressed will be categorized as findings and recommendations. Overall, HSPD-9 does not protect the safety of the nation's agricultural infrastructure and food supply against future terrorist attacks.

Finding: Many locations, whether a seaport terminal, river or railroad grain terminal can provide terrorists low risks and high pay off targets. They have the potential to cause tremendous economic destabilization. With 351 U.S. seaports and 88,000 miles of tidal coastline and numerous navigable inter-coastal river waterways, protecting the nation's maritime system from terrorists presents a daunting challenge.⁶¹

Protecting U.S. rivers, lock and dam systems, seaports, and maritime transportation system is of critical importance to the nation as the maritime industry contributes \$742 billion to the GDP annually.⁶² Over two billion tons of domestic and import/export cargo traffic, much of it as agricultural commodities, pass through our nation's seaports and river waterways annually.⁶³ The consequences of just one attack is estimated to run as high as \$1 trillion in economic costs and is immeasurable in human costs.⁶⁴ The economic implications of shutting down even one of the nation's largest seaports for an extended period of time due to security fears or inefficient port inspection procedures which are already fundamentally flawed, could trigger a recession.⁶⁵

The U.S. has a significant cargo inspection problem. Ninety-five percent of all cargo entering the U.S. passes through one of the nation's 351 maritime seaports. Of the 8,000 foreign commercial vessels that make 60,000 port calls approximately 95 percent of the cargo is

not inspected. The magnitude of this problem is expected to double by 2025.⁶⁶ There is currently no effective and reliable means to confirm that a ship does not transport infectious livestock or crop diseases or WMD. Maritime transportation experts warn that global port systems can and will be exploited by terrorists with ships and/or containers filled with infectious diseases and/or explosive chemical, biological, or nuclear devices.⁶⁷ It is simply a matter of when and where such attacks will occur. Not acting quickly to fix current vulnerabilities may have devastating consequences.

The *Maritime Transportation Anti-Terrorism (MTAT) Act of 2002* implemented many new improvements in port planning and hardening of ports against terrorist attacks in the U.S. The down side to port security improvements is that federal grant funding is parochial and many locations will not receive funding necessary to implement plans outlined in the intended MTAT Act of 2002.⁶⁸

Recommendation: An improved and proactive seaport security system must be designed that addresses current terrorist threat conditions. As an alternative to hardening onshore seaports, the U.S. government needs to fund and procure a few offshore port systems to evaluate their effectiveness and efficiency. This strategy will move existing vulnerabilities away from onshore ports and human population centers, reduce the overall costs to safeguarding onshore seaport infrastructure, and save lives.

Offshore ports would build upon the U.S. government's Container Security Initiative (CSI) by providing the opportunity to scan and inspect a high percentage of suspect cargo several miles offshore. CSI is an initiative that employs U.S. custom agents at 42 foreign ports to prescreen and target high risk cargo. An offshore port system would prevent a ship-based dirty bomb attack from affecting U.S. population's centers by offloading, scanning, and reloading cargo onto secured lighter ships or barges, preventing any foreign vessel from reaching U.S. shores.

The current cargo inspection and port security system in the U.S. is incapable of preventing or managing the consequences of deliberately introducing a highly contagious livestock and crop disease, or a WMD. It is now time to fix the problem. Adding offshore ports and hardening high priority onshore ports can add diversity to a port security system that will contravene how terrorists plan to attack us, how we respond to them when attacked, and how we mitigate the severity of damage to property and human lives. Offshore ports provide a more economical solution that will allow the U.S. to apply limited resources to other more vulnerable infrastructure areas.

Finding: The core of the federal government's scientists, support staff and laboratories dedicated to research and diagnosis of foreign animal diseases that threaten U.S. livestock are located at the Plum Island Animal Disease Center (PIADC) on Plum Island, NY. The PIADC is an essential component of the national strategy for protecting U.S. agriculture from a bioterrorist attack involving the intentional introduction of foreign animal diseases, such as FMD, Spongiform Encephalopathy or Mad Cow Disease, Anthrax, West Nile Virus, African Swine Fever. This facility becomes increasingly more costly to maintain, lacks sufficient laboratory and test space to support the increased levels of research and development needed to meet the growing concerns about accidental or intentional introduction of foreign animal diseases, and is completely inadequate to address zoonotic diseases.

There are only two biosafety level 4 (BSL4) laboratories designed with diagnosing the most hazardous animal pathogens and high consequence zoonotic diseases in the U.S., the National Veterinarian Services Laboratories in Ames, Iowa and PIADC at Plum Island, New York. By law, infectious animal diseases can only be studied and FMD testing is only allowed at Plum Island.⁶⁹ HSPD-9 called for a plan to construct a safe, secure and state-of-the-art animal bio-containment facility at the National Animal Disease Center to research and develop diagnostic capabilities for foreign animal and zoonotic diseases. Most laboratories experience lack of capacity, the trained staff, and the surge capacity needed if an emergency happens. A new National Bio and Agro Defense Facility rated as a BSL 4 is to begin design studies in 2006 and construction is estimated to be completed by 2010.

Recommendation: Significant funding needs to be appropriated to protect foreign animal and zoonotic disease laboratories such as the National Animal Disease Center, National Veterinarian Services Laboratories and National Bio and Agro Defense Facility. The Plum Island facility has outlived its expected life cycle and urgently needs to be replaced to expand its capabilities for conducting foreign animal disease research and diagnostic testing. The National Veterinary Services Laboratories, responsible for training and approving personnel at state and university diagnostic laboratories to conduct diagnostic tests for foreign animal diseases also needs extensive modernization and expansion of its capabilities.

Finding: Vaccines cannot be deployed within 24 hours of an outbreak as called for in HSPD-9. Supplies are presently limited because USDA maintains vaccines for only one foreign animal disease, foot and mouth disease.

Recommendation: The National Veterinary Stockpile Steering Committee needs to expand current levels of research and development and determine specific animal vaccines, antiviral and therapeutic products and appropriate time for their deployment to respond to the

most dangerous animal diseases affecting human health and the economy within 24 hours of an outbreak.⁷⁰

In December 2003, two federal government expert blue panels identified 10 animal diseases to be of the highest priority for vaccine and anti-viral research and development. These diseases include: Foot and Mouth Disease (FMD), Rift Valley Fever (RVF), Nipah Virus, Avian Influenza, Exotic Newcastle Disease, Classical Swine Fever, African Swine Fever, Venezuelan and Eastern Equine Encephalitis, and Rinderpest.⁷¹

Finding: The transfer of agricultural inspectors from USDA to DHS in 2003 resulted in a decline in the number of agricultural inspections conducted at ports of entry while imports into the nation increased. DHS has been unable to fill over 500 vacancies and delays in securing background checks and training new employees has created inefficiencies. Inspectors state they do not receive timely information about high-risk cargo that needs to be inspected, and call for improved information sharing.

Recommendation: Secretaries of DHS and USDA should analyze agricultural inspection data to identify reasons for the decline in the number of agricultural inspections conducted and implement aggressive measures to complete background checks on all new employees, and hire and train dedicated personnel to perform these functions.⁷²

Finding: USDA has already developed effective rapid diagnostic tools to detect the six most dangerous diseases likely to affect livestock in the U.S. Currently USDA does not allow the use of rapid diagnostic tools to test animals at remote sites of an outbreak. They use this technology only at selective regional laboratories. USDA is reluctant to use these tools outside a contained laboratory because samples may contain a live virus that could infect livestock and wildlife and personnel have not been trained to use these tools. The on-site use of these tools is critical to speeding diagnosis, containing disease, and minimizing the number of animals that need to be slaughtered.⁷³

Recommendation: USDA must enhance its ability to quickly identify and control diseases by lifting their current restriction on using rapid diagnostic tools at the site of an outbreak and hire and train additional technicians to use these tools. Rapid surveillance, gathering and sharing of intelligence information and detection of foreign animal diseases is crucial to minimizing the scope of a natural outbreak or deliberate terrorist incident.

Finding: Because an estimated 85 percent of our nation's critical infrastructure is owned by the private sector, American corporations and other commercial organizations need to play a central role in protecting the homeland. Poor communication between government agencies at the federal, state and local levels, and between public and private sectors continue to hinder

governmental and industry organizational leaders in their efforts to adopt an effective approach to agricultural terrorism preparedness and prevention.⁷⁴

Recommendation: DHS needs to take an aggressive role involving governmental agencies, agricultural industry groups and private sector organizations to develop and integrate collaborative network systems that gather and share information, intelligence, and technology to merge and analyze threats using databases, guidance and response plans. These stakeholders also need to conduct periodical exercises at the local, county and state levels to ensure they fully understand their roles and responsibilities in response to domestic emergency incidents, uncover shortfalls and test solutions.

Priority Actions - The Way Ahead

This section will identify protective measures that need to be implemented to strengthen the effectiveness of HSPD-9 and provide a list of recommendations to mitigate risks facing the nation's agricultural infrastructure and food supply.

There will never be a 100 percent guarantee of security for the people and the economy. We must resist the urge to seek total security as it is not realistic or achievable. It can potentially drain the nation's limited resources, and attention from those areas that can be accomplished.

Billions of federal dollars have begun flowing to state and local municipalities to protect infrastructure and citizens. While this funding will improve preparedness in many areas, the lack of a national plan, standards, prioritization, and clear guidance may lead to ineffective application of funds. We are poised to improve the nation's readiness but only if we pursue a disciplined and deliberate approach that ensures that we have spent limited resources wisely and to the best ends.

Many of the challenges presented by the tasks of homeland security are ubiquitous. They affect the personal safety of every American and impact every aspect of the nation's political, financial, transportation, health, and legal systems. Prognostication about the amount of future funding that the federal government should provide is premature. By some estimates, \$100 billion is spent every year protecting Americans from harm.⁷⁵ Some argue that this is an attempt to establish an overall price tag that is speculative and politically unwise.

The U.S. government needs to clearly articulate an end state, determine acceptable levels of risk, determine preparedness levels to be achieved, and identify a reasonable way to measure results. The U.S. government should evaluate present efforts, continue to analyze vital requirements and prioritize resources to be funded. To ensure improved and continued

preparedness, the federal government must continue to provide sustained, assured levels of federal funding, so that states and localities can plan and implement programs with federal funds and their own funding with more certainty.

Funding should be provided through a formula based on risks or threats, level of vulnerability, and consequences. Funding should not be based solely on consideration of vulnerability or fear alone. Performance measures must be established and evaluations conducted to ensure that funds are used wisely and are effectively improving and maintaining preparedness. Risk based funding makes good practical sense but current threat and vulnerability data are not sufficient to implement such a process in the future.

DHS should provide strong leadership on coordinating federal interagency strategy to combat bioterrorism. USDA's strategic vision and technical advice to DHS must emphasize integrated coordination and partnership with all agencies, organizations and private interests that have relevant roles, responsibilities, and stakes in program outcomes. The investment in protecting the agricultural industry will not be cheap. An aggressive, well coordinated effort to combat agricultural bioterrorism will have substantial ancillary benefits. Actions implemented could improve the safety of America's food, strengthen partnerships, improve coordination among agencies and organizations, and when these actions have shown to be effective, it may serve as a model for other counterterrorism efforts.

Specific actions need to be taken across all levels of the agricultural industry. Food source chain of custody monitoring, surveillance and inspections at processing, transportation and distribution nodes will prevent the spread of mistakenly contaminated as well as intentionally contaminated food. Improving physical security protective measures through monitoring and surveillance and limiting access to agricultural production and storage facilities is the first line of defense against contamination and the deliberate introduction of diseases.

Agricultural commodity producers need to assess risks and implement appropriate plans and measures to mitigate risks. Protective measures include: installation of lighting, inventory and securing of hazardous materials, safeguarding feed supplies, securing water wells, securing facility boundaries to prevent unauthorized access, reporting suspicious activity and suspected cases of contamination or disease outbreaks. The use of biosecurity management practices that consist of isolating contact, minimizing traffic control and sanitation are all designed to prevent the spread of disease by minimizing the movement of biological organisms and vectors.

Conclusion

The U.S. is vulnerable to bioterrorism directed against our nation's agricultural infrastructure and food supply. Biological agents and invasive species are widely available for intentional introduction into agricultural plants and animals and pose a substantial threat to the U.S. food supply. The current U.S. agricultural defense system is inadequate against premeditated terrorist acts.

Since HSPD-9 was published, significant progress has been achieved. However, serious gaps in protecting the safety of the nation's food supply against future terrorist attacks exist. Additional ways and means to further harden and protect the U.S. agricultural infrastructure and food system need to be adopted. Public citizens and taxpayers need to demand accountability from their elected leaders. Lawmakers need to be constantly reminded that the citizen's safety and well-being is paramount.

Although an attack directed against any concentrated area of the nation's food supply is unlikely to result in widespread famine or malnutrition, the potential damage in terms of direct and indirect costs is serious. Risks include adverse public health effects, loss of public confidence in the food system and in public officials widespread public concern and confusion.

Losses caused by trade restrictions and the public's sensitivity about food safety and any disease outbreak or even a hoax could have significant economic, social and psychological consequences. Policymakers and agricultural industry organizational leaders need to ensure strong pro-active protective measures are implemented to safeguard the U.S. agricultural infrastructure and food system before a catastrophic tragedy occurs.

Endnotes

¹ George W. Bush, Homeland Security Presidential Directive 9 (HSPD-9), "Defense of United States Agriculture and Food," (Washington, D.C.: The White House, January 30, 2004), 1.

² Webster's Dictionary, *Webster's Eleventh Collegiate Dictionary*, Eleventh Collegiate ed. (Springfield, MA: Merriam-Webster, Inc., 2003), 26.

³ Ibid.

⁴ Peter Chalk, "Terrorism, Infrastructure Protection, and the U.S. Food and Agricultural Sector," U.S. Senate Subcommittee on Oversight of Government Management, Restructuring, and the District of Columbia, (Washington, D.C.: Policy Analyst, RAND Washington Office, 10 October 2001), 5-8.

⁵ Jim Molke, Congressional Research Service Report for Congress, The Library of Congress, "Agroterrorism: Threats and Preparedness", August 13, 2004, Summary.

⁶ Robert J. Pratt, "Invasive Threats to the American Homeland," *Parameters, U.S. Army War College Quarterly*, Vol. 34, No. 1, (Spring 2004): 44-45.

⁷ Kathleen C. Bailey, "The Biological and Toxin Weapons Threat to the United States," National Institute for Public Policy, October 2001. Available from http://www.nipp.org/Adobe/Toxin%20_Weapons2.pdf; Internet; accessed 18 October 2005, 2-3.

⁸ Ibid.

⁹ Ibid.

¹⁰ Ibid.

¹¹ Ibid.

¹² Ibid.

¹³ Barry S. Zellen, "Preventing Armageddon II: Confronting the Specter of Agriterror," *Strategic Insights*, Volume III, Issue 12, Center for Contemporary Conflict, Naval Postgraduate School, Monterey, CA, (December 2004): 4.

¹⁴ K.M. Peters, *Growing Threat – Officials Across the Country Worry that Terrorists are Planning an Attack on the Vulnerable Agricultural Sector*. Government Executive, 2003, June. Al Qaeda's interest in American agriculture was more than academic, according to government officials. It should not be surprising that a determined enemy like al Qaeda would consider ways to disrupt U.S. food supplies, 1.

¹⁵ Floyd P. Horn, former Director of Food, Agriculture, and Water Security at the White House, Office of Homeland Security, forward.

¹⁶ M. Thornton and C. Noun, (2001). FB Urges President to Name Specialist to Prevent Agroterrorism. The voice of Agriculture Newsroom. 25 September 2003. Available from <http://fb.org/news/nr/nr2001/nr1002.html>; Internet; accessed 3 October 2005. Bob Stallan, President of the American Farm Bureau Federation stated, "As the nation and the world prepare to embark on a war against terrorism there are concerns and speculation regarding how agriculture and other sectors of the economy will be affected" the Voice of Agriculture Newsroom, 1.

¹⁷ U.S. Census Bureau, Statistical Abstract of the United States: 2004-2005 (124th edition), The National Data Book, (Washington, D.C.: U.S. Government Printing Office, 2004), 527.

¹⁸ U.S. Congress, Senate Subcommittee on Oversight of Government Management, Restructuring and the District of Columbia. Terrorism, Infrastructure Protection, and the U.S. Food and Agriculture Sector. Over the past decade, many states, particularly in North America and Western Europe, have made substantial investments in improving their ability to detect, prevent and respond to terrorist threats and incidents. This has fed into an increasingly well protected public infrastructure throughout much of the developed world. Agriculture is one area

that has received very little attention in this regard, however. "Terrorism, Infrastructure Protection, and the U.S. Food and Agriculture Sector." Peter Chalk, 1. Institute for National Strategic Studies. "Agricultural Bioterrorism: A Federal Strategy to Meet the Threat". March 2002. (McNair Paper 65). Nevertheless, little attention has been given to agricultural biowarfare and bioterrorism.

¹⁹ United States Government Accountability Office, Report to Congressional Requesters, Homeland Security, Highlights of GAO-05-214, "Protecting Against Agroterrorism: Much Is Being Done to Protect Agriculture from a Terrorist Attack, but Important Challenges Remain," (Washington, D.C.: U.S. Government Accountability Office, March 2005), 55.

²⁰ Molke, 14.

²¹ Ibid., 14-15.

²² Congress of the United States Congressional Budget Office, A CBO Paper, "Homeland Security and Private Sector," (December 2004): 43.

²³ Thomas J. Johnson, "A History of Biological Warfare from 300 B.C.E. to the Present". Available from <http://www.aarc.org/resources/biological/history/index.asp>; Internet; accessed 21 October 2005. From poisoned arrows (Scythians, and later the Viet Cong guerrillas) to poisoned wells (Sparta, Persia, Rome and others) to bombs with deadly bacteria (Japan, United States, Soviet Union and Iraq), the intentional use of biowarfare has been around for centuries.

²⁴ Ibid. The bubonic plague is primarily a disease of rats and other rodents. Only when they become very numerous in close contact with humans does the plague arise in man. It was widely reported that in 1346-1347, plague broke out in the Tartar army during the siege of Kaffa (in Crimea). The plague epidemic that followed forced the defenders to surrender. Some historians believe that this was the cause of the epidemic of plague that swept across medieval Europe, killing 25 million. It has been reported that Russian troops may have used a similar strategy involving corpses of plague victims against Sweden in 1710.

²⁵ Ibid. The first recorded "weaponized" biological agent in North America occurred during the French and Indian Wars (1754-1767). The agent was smallpox. The method of delivery was blankets not bombs.

²⁶ Ibid.

²⁷ Ibid. Little known and yet remarkable in its scope is Japan's biological warfare program during World War II. Probably, the most extensive and most horrific biological weapons research and development occurred in Manchuria from 1932 until the end of the war. This program, innocuously entitled as Unit 731 was located in Pingfan Manchuria. Experimentation on prisoners using Shigella (bacterial dysentery), Vibrio cholerae (cholera) and Yersinia pestis (the bubonic plague) was part of the Unit 731 program, 7.

²⁸ Ibid. The U.S. program investigated the use of *Bacillus anthracis* (anthrax), botulinum toxin (botulism), *Yersinia pestis* (plague), *Francisella tularensis* (tularemia), *Coxiella burnetii* (Q fever), Venezuelan equine encephalitis virus, *Brucella suis* (brucellosis), and *Staphylococcal enterotoxin B*. Production of weapons also occurred at other sites in Arkansas and Colorado.

The U.S. tested bioweapons dispersal methods by releasing the harmless, but easily identifiable, *Serratia marcescens* over San Francisco, in 1950.

²⁹ Ban J., "Agricultural Biological Warfare: An Overview". Chemical and Biological Arms Control Institute (2000), Overview of Agricultural Biosecurity, Historical Perspective of Past Incidents of Agroterrorism, Center for Infectious Disease Research and Policy, Academic Health Center, University of Minnesota (2005). Available from <http://www.cidrap.umn.edu/cidrap/content/biosecurity/ag-biosec/biofacts/agbiooview.html>; Internet; accessed 11 November 2005.

³⁰ Johnson. The results of the experimental release of *bacillus subtilis* in the New York City subway system showed that the release of an organism in just one station would infect the entire underground subway system due to winds and vacuum created by the passing subway trains. The declassified information was published in Leonard Cole's 1998 book, *Clouds of Secrecy*. One wonders if it was read by the cult Aum Shinrikyo for its planning of a nerve gas (sarin) attacks on the Tokyo subway in March 1995.

³¹ Ibid.

³² Ibid. They were later discovered to have developed and attempted to use other chemical agents (VX gas and hydrogen cyanide) and biological agents (*B. anthracis*, *Coxiella burnetii*, Ebola virus, and botulinum toxin) on at least ten other occasions. Their multiple attacks using sarin gas killed at least 20 people and injured more than 1,000 others.

³³ Pratt, 46-47.

³⁴ Colin G. Scanes and John A. Miranowski, eds., *Perspectives in World Food and Agriculture 2004*, (Blackwell Publishing Company, Ames, IA, 2003), quoted by Radford G. Davis, "Agroterrorism: Need for Awareness," Chapter 23, 387.

³⁵ George W. Bush, The National Security Strategy of the United States of America, (Washington, D.C.: The White House, September 17, 2002), Introduction – 31.

³⁶ George W. Bush, The National Strategy for Homeland Security, Office of Homeland Security, (Washington, D.C.: The White House, July 16, 2002), 30.

³⁷ U.S. Census Bureau, Statistical Abstract of the United States: 2004-2005 (124th edition), The National Data Book, (Washington, D.C.: U.S. Government Printing Office, 2004), 234.

³⁸ Davis, 358.

³⁹ U.S. Census Bureau, 537.

⁴⁰ Robert E. Armstrong, senior research fellow in the Center for Technology and National Defense University, "From Petro to Agro: Seeds of a New Economy," *Defense Horizons*, No. 20, (October 2002): 1.

⁴¹ National Agricultural Biotechnology Council, Vision for Agricultural Research and Development in the 21st Century, December 14, 1998.

⁴² Armstrong, 2.

⁴³ Ibid., 529.

⁴⁴ Ibid., 532.

⁴⁵ Ibid., 532.

⁴⁶ Jeff Greco, "Agricultural Terrorism in the Midwest: Risks, Threats and State Responses," A Report from the Agricultural Committee of the Midwestern Legislature Conference, The Council of State Governments (December 2002): 6.

⁴⁷ Ibid., 544-546.

⁴⁸ Ibid.

⁴⁹ Chalk, A study by the USDA has calculated, for instance, that if African Swine Fever (ASF) were ever to become entrenched in the U.S., the cost over a ten year period would be \$5.4 billion. Over 1 billion GBP was paid in compensation to farmers affected by the 2001 FMD outbreak in the UK (claims for each farm were in the range of 115,000 GBP); tourism receipts were also hit hard as a result of cancellations brought about by the quarantine of farms located in or near popular holiday destinations such as the Lake District. Very much indicative of the potential scale of these losses was a blanket ban that was imposed on Taiwanese pork exports following a particularly devastating outbreak of FMD between March and July 1997. The embargo caused Taipei's GDP to fall by a full two percentage points almost overnight.

⁵⁰ For an overview of the threat of biological agroterrorism see Anne Kohnen, "Responding to the Threat of Agroterrorism: Specific Recommendations for the United States Department of Agriculture," BCSIA Discussion Paper 2000-29, ESDP Discussion Paper ESDP-2000-04, John F. Kennedy School of Government, Harvard University (October 2000). Estimates for the cost of food-borne illness vary considerably based upon what criteria are used. See Jean C. Buzby, et al., "Bacterial Foodborne Disease: Medical Costs and Productivity Losses," Agricultural Economics 741 (August 1996). Available from <http://www.ers.usda.gov/publications/Aer741/index.htm>; Internet; accessed 24 October 2005.

⁵¹ Ibid.

⁵² Ibid. The outbreak of contagious zoototic disease or a major food contamination scare would be most significant in this regard, especially in the event that human deaths actually occurred.

⁵³ John Sherwood, Jacqueline Fletcher and James Swyers, eds., *Crop Biosecurity: Are We Prepared?*, White Paper, Developed by the Public Policy Board of the American Phytopathological Society (APS), May 2003, 2.

⁵⁴ George W. Bush, Homeland Security Presidential Directive 9 (HSPD-9), "Defense of United States Agriculture and Food," (Washington, D.C.: The White House, January 30, 2004), 1.

⁵⁵ Radford G. Davis, *Agricultural Bioterrorism*, Available from <http://www.actionbioscience.org/newfrontiers/davis.html>; Internet; accessed 14 October 2005.

Government Executive, 2003, Growing Threat - Officials across the country worry that terrorists are planning an attack on the vulnerable agricultural sector.

⁵⁶ John L. Richard, et al., *Mycotoxins: Risks in Plants, Animal, and Human Systems* (Ames, IA: Council for Agricultural Science and Technology, January 2003), 10.

⁵⁷ Ibid.

⁵⁸ Peters, 26.

⁵⁹ Sherwood, Fletcher and Swyers, 2.

⁶⁰ George W. Bush, Homeland Security Presidential Directive 9 (HSPD-9), "Defense of United States Agriculture and Food,: (Washington, D.C.: The White House, Jnauary 30, 2004), 1.

⁶¹ Michael J. Hillyard,"Redesigning America's Cargo and Port Security System," *Journal of Counterterrorism and Homeland Security International*, Vol. 11, No. 4, (2005): 15.

⁶² Pamela Junot, "New Legislation Calls for Increased Antiterrorism Efforts at U.S. Ports," *Journal of Counterterrorism and Homeland Security International*, Vol. 8, No. 3, (2002): 16.

⁶³ Ibid.

⁶⁴ Hillyard, 15.

⁶⁵ Ibid.

⁶⁶ Ibid.

⁶⁷ Ibid.

⁶⁸ Junot, 16.

⁶⁹ Plum Island Foreign Animal Disease Laboratory. Available from http://www.globalsecurity.org/wmd/facility/plum_island.htm; Internet; accessed 12 December 2005.

⁷⁰ GAO-05-214, 6-7.

⁷¹ James A. Roth, Director of the Center for Food Security and Public Health at Iowa State University, Ames, IA, testimony before a full U.S. Senate Committee Hearing in Washington, D.C. on Biosecurity and Agroterrorism , July 20, 2005. Available from <http://agriculture.senate.gov/Hearings/hearings.cfm?hearingid=1572&witnessId=4472>; Internet; accessed 4 October 2005.

⁷² GAO-05-214, 7.

⁷³ Ibid., 31-36.

⁷⁴ Ibid., 66.

⁷⁵ While the National Strategy for Homeland Security (September 2002), p. xiii, reports the “United States spends roughly \$100 billion per year on homeland security,” the actual amount is open to debate. The cited estimate includes DHS agencies and federal, state, and local first responders and emergency services, but excludes most military spending. Private sector estimates of total homeland security spending, which sometimes include international purchases of technology, range up to \$138 billion a year. However, some far lower estimates focus on the increased spending due to the terrorist threat and exclude “normal” spending on law enforcement, fire fighting, and emergency services.